In the claims:

1. (Canceled)

2. (Canceled)

3. (Canceled)

4. (Canceled)

5. (Canceled)

6. (Canceled)

7. (Canceled)

8. (Canceled)

9. (Canceled)

10. (Canceled)

11. (Canceled)

12. (Canceled)

13. (Canceled)

14. (Canceled)

15. (Canceled)

16. (Canceled)

17. (Canceled)

18. (Canceled)

19. (Canceled)

20. (Canceled)

21. (Canceled)

22. (Canceled)

23. (Canceled)

24. (Canceled)

25. (Canceled)

26. (Canceled)

27. (Canceled)

28. (Canceled)

29. (Canceled)

30. (Canceled)

31. (Canceled)

32. (Canceled)

33. (Canceled)

34. (Canceled)

35. (Canceled)

36. (Canceled)

37. (Currently Amended) An integrated circuit comprising:

a substrate having a Polymer Electrolyte Membrane (PEM) fuel cell Membrane Electrode Assembly (MEA) portion further comprising:

a porous region of said planar substrate having a front surface and an opposing back surface;

catalyst material affixed to said back surface and sidewalls of said porous region;

~~polymer electrolyte~~ proton exchange material affixed to said front surface of planar substrate, the polymer electrolyte material having an anode surface and an opposing cathode surface;

an anode conductor coupled with said anode surface of said polymer electrolyte material, the anode conductor patterned in a polygonal array;

a gas-diffusion electrode affixed to said anode conductor;

a cathode conductor electrically coupled with said conductive portion of substrate wherein said cathode conductor is coplanar in relation to said anode conductor; and

said substrate also having an integrated circuit portion operably coupled to said MEA portion, wherein the integrated circuit portion includes at least one active circuit component and at least one passive circuit component.

38. An integrated circuit according to claim 37 wherein said integrated circuit portion comprises a fuel cell control circuit.

39. An integrated circuit according to claim 37 wherein said integrated circuit portion comprises a driven device.

40. An integrated circuit according to claim 37 further comprising a fuel cell body operably connected to said MEA portion.

41. An integrated circuit according to claim 37 wherein said planar substrate comprises silicon.

42. An integrated circuit according to claim 37 wherein said planar substrate comprises silicon and sapphire.

43. An integrated circuit according to claim 37 wherein said substrate comprises one or more semiconductor compound selected from the group known as the III-V family.

44. (Currently Amended) An integrated circuit according to claim 37 wherein said ~~polymer electrolyte~~ proton exchange material comprises a perfluorocarbon copolymer proton-conducting material.

45. (Currently Amended) An integrated circuit according to claim 37 wherein said polymer electrolyte material comprises ~~NAFION~~ a perfluorosulfonic acid polymer~~, a registered trademark of I. E. DuPont Nemours and Company~~.

46. (Currently Amended) An integrated circuit according to claim 37 wherein said ~~polymer electrolyte~~ proton exchange material is less than approximately 30 ~~mils~~ microns thick.

47. (Currently Amended) An integrated circuit according to claim 37 wherein said ~~polymer electrolyte~~ proton exchange material is less than approximately 5 ~~mils~~ microns thick.

48. (Currently Amended) An integrated circuit according to claim 37 wherein said ~~polymer electrolyte~~ proton exchange material is less than approximately 1 ~~mil~~ microns thick.

49. An integrated circuit according to claim 37 wherein said catalyst comprises one or more metals selected from the group platinum, iridium, palladium, gold, and nickel.

50. An integrated circuit according to claim 37 wherein said catalyst comprises platinum.

51. An integrated circuit according to claim 37 wherein said catalyst comprises an alloy of platinum and rhodium.

52. (Currently Amended) An integrated circuit according to claim 37 further comprising a layered stack of catalyst and palladium disposed between said front surface of said porous region of said planar substrate and said ~~polymer electrolyte~~ proton exchange material.

53. (Currently Amended) An integrated circuit according to claim 37 further comprising a transition layer disposed between said ~~polymer electrolyte~~ proton exchange material and said anode conductor for lowering lateral electrical resistance.

54. An integrated circuit according to claim 37 further comprising a water barrier adjacent to said back surface catalyst material.